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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/935,012	08/21/2001	Larry A. Coldren	510015-265	1464

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EXAMINER

FLORES RUIZ, DELMA R

ART UNIT PAPER NUMBER

2828

DATE MAILED: 11/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/935,012

Applicant(s)

COLDREN ET AL.

Examiner

Delma R. Flores Ruiz

Art Unit

2828



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.


- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 August 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-42 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-42 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

  
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**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3,4. 6) ☐ Other:

## DETAILED ACTION

### *Drawings*

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description:

The DBR 28 and 30 on page 10, lines 1 – 2.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

*Claims 1-42 are functional, vague, and indefinite. The claims fail to recite any means plus function in order to render the structure as recited in the claims. 35 USC 112, 2nd paragraph.*  
**Claim Rejections - 35 USC § 102**

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1 – 3, 10, 12, 13, 15, are rejected under 35 U.S.C. 102(b) as being anticipated by Sugiyama et al (5,392,307).

**Regarding claims 1 – 3** Sugiyama discloses a distributed Bragg reflector for use in vertical cavity surface emitting laser (VCSEL), comprising a plurality of layers of semiconductor material doped to reduce voltage drop and optical loss in a VCSEL, the plurality of layers including at least one layer having the element antimony (Sb), wherein the plurality of layers of semiconductor material also including the elements arsenic, aluminum, and gallium (see Figs. 1 –2, 4 – 5, Column 5, lines 59 – 67, Column 6, lines 1 – 51). The pluralities of layers of semiconductor material are epitaxially grown on a substrate (Column 5, lines 58 – 67). The substrate includes indium phosphide (InP) (Column 7, lines 48 – 49).

**Regarding claims 10 and 15** Sugiyama discloses a distributed Bragg reflector for use in vertical cavity surface emitting laser (VCSEL), comprising a plurality of layers of semiconductor material are configured to form a reflective device and the mirror portion is n-doped to reduce voltage drop and optical loss in a VCSEL (see Figs. 1 –2, 4 – 5, Column 2, lines 52 – 67, Column 5, lines 36 – 67, and Column 6, lines 1 – 51).

**Regarding claim 12 and 13** Sugiyama discloses a device for reflecting light to an active region in a vertical cavity surface emitting laser VCSEL, comprising: a mirror portion including the element antimony (Sb) epitaxially grown on the substrate (Column 6, lines 42 – 52), the mirror portion including layers of semiconductor material,

wherein electric current is pumped through the plurality of layers forming the mirror portion to electrically pump the active region (see Figs. 1 –2, 4 – 5, Column 2, lines 52 – 67, Column 5, lines 36 – 67, and Column 6, lines 1 – 51). The substrate includes indium phosphide (InP) (Column 7, lines 48 – 49).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4 – 8, are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiyama et al (5,392,307) in view of "Accurate control of Sb composition in AlGaAsSb alloys on InP substrate by molecular beam epitaxy" by G. Almuneau, E. Hall, S. Mathis and L.A. Coldren (July 26, 1999).

***Regarding claims 4 – 8***, Sugiyama discloses the claimed invention except for the distributed Brag reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where "a" and "b" indicate relative proportions of atoms and "a" is greater than 0.9 or less

0.3 in one layer of the alternating layer pairs and less than 0.9 or 0.3 in another layer of the alternating layer pairs and "a" is less than 0.3 in one layer of the alternating layer pairs "a" is large enough such that the layer is substantially transparent to lasing light. It would have been obvious at the time of applicant's invention, to combine "Accurate control of Sb composition in AlGaAsSb alloys on InP substrate by molecular beam epitaxy" by G. Almuneau, E. Hall, S. Mathis and L.A. Coldren (July 26, 1999) of teaching a distributed Brag reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where "a" and "b" indicate relative proportions of atoms and "a" is greater than 0.9 or less 0.3 in one layer of the alternating layer pairs and less than 0.9 or 0.3 in another layer of the alternating layer pairs and "a" is less than 0.3 in one layer of the alternating layer pairs "a" is large enough such that the layer is substantially transparent to lasing light with DBR and VCSEL because it would have been obvious to one of ordinary skill in the art at the time the invention was made to distributed Brag reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where "a" and "b" indicate relative proportions of atoms and "a" is greater than 0.9 or less 0.3 in one layer of the alternating layer pairs and less than 0.9 or 0.3 in another layer of the alternating layer pairs and "a" is less than 0.3 in one layer of the alternating layer pairs "a" is large enough such that the layer is substantially transparent to lasing light, since it has been held that where the general conditions of a claim are disclosed in the

prior art, discovering the optimum or working ranges involves only routine skill in the art.  
In re Aller, 105 USPQ 233.

Claims 17, 18, 27, 29, 30, 31, 32, 41 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiyama et al (5,392,307) in view of WO 98/07218, Jayaraman (February 19, 1998).

**Regarding claims 17, 18, 27, 29, 30, 31, 32, 41 and 42,** Sugiyama discloses a device for reflecting light to an active region in a VCSEL, comprising; a pair of mirror portion including the element antimony (Sb) epitaxially grow on the substrate (Column 6, lines 42 – 52), pair the mirror portion including of layers of layers stacks of paired semiconductor material, an active region epitaxially grown on the substrate and positioned between the pair of mirror portions(see Figs. 1 –2, 4 – 5, Column 2, lines 52 - 67, Column 5, lines 36 – 67, and Column 6, lines 1 – 51); the substrate includes InP (Column 7, lines 48 – 49). The pairs of mirror portion includes a first mirror portion positioned on a top of the active region and a second mirror portion positioned below the active region and the active region is grown to include a cavity having five strain compensated quantum wells, the quantum wells including the elements aluminum, indium, gallium and arsenic, the VCSEL operates in the approximate range from between 1.3  $\mu\text{m}$  and 1.6 $\mu\text{m}$  and a substrate on which a pair of mirror portions, an active region and at least one metal contact disposed on the substrate, wherein electric

current is pumped through the pair of mirror portions to electrically pump the active region (see Figs. 1 –2, 4 – 5, Column 2, lines 52 - 67, Column 5, lines 36 – 67, and Column 6, lines 1 – 51).

Sugiyama discloses the claimed invention except for a doped tunnel junction configured to provide electron-hole conversion from one of the pair of mirror portion; and wherein the pair of a mirror portions, the active region and the tunnel junction are epitaxially grown on the substrate in a single step, and wherein electric current is pumped through the pair of mirror portions to electrically pump the active region and a tunnel junction are epitaxially grown in a single step in which semiconductor elements are deposited to form a multi-layered structure. It would have been obvious at the time of applicant's invention, to combine WO 98/07218, Jayaraman (February 19, 1998) of teaching a doped tunnel junction configured to provide electron-hole conversion from one of the pair of mirror portion; and wherein the pair of a mirror portions, the active region and the tunnel junction are epitaxially grown on the substrate in a single step, and wherein electric current is pumped through the pair of mirror portions to electrically pump the active region and a tunnel junction are epitaxially grown in a single step in which semiconductor elements are deposited to form a multi-layered structure. It would have been obvious at the time of applicant's invention with VCSEL because a vertical cavity surface emitting laser (VCSEL) includes a bottom mirror stack disposed above a semiconductor substrate, an optical cavity including an active region disposed above the bottom mirror stack, and a top mirror stack disposed above the optical



cavity. A tunnel junction interface between an n-doped layer of GaAs and a p-doped layer of GaAs for converting electrons to holes is incorporated in the optical cavity or in the period of either of the mirror stacks adjacent the optical cavity. The tunnel junction interface effectively converts n carriers to p carriers, which eliminates the need for a p-type contact. As a result, the VCSEL is able to include a second n-type contact, rather than the p-type contact suggested by conventional techniques, and a thin p-doped GaAs layer. The advantages of having a second n-type contact rather than a p-type contact include a lower electrical resistance and lower optical loss for the VCSEL. When the invention is embodied in a VCSEL with an intracavity contact, one of the mirrors can be undoped. This further reduces optical loss for the VCSEL. The VCSEL can be electrically pumped using first and second contacts to n-material portions of the VCSEL to emit coherent electromagnetic radiation having a wavelength in a range from 1250 nm to 1650 nm.

Claims 9, 11, 14, 16, 24 – 26, 28, and 38 – 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiyama et al (5,392,307) in view of in view of WO 98/07218, Jayaraman (February 19, 1998).

**Regarding claims 9, 11, 14, 16, 24 – 26, 28, and 38 – 40** Sugiyama discloses the claimed invention except for the substrate is n-doped with the element selenium (Se), the reflective device is n-doped using tellurium, the doped tunnel junction is

n-doped with silicon (Si), and the doped tunnel junction is p-doped with  $\text{CBr}_4$ . It would have been obvious at the time of applicant's invention, to combine WO 98/07218, Jayaraman of teaching a substrate is n-doped with the element selenium (Se), the reflective device is n-doped using tellurium, the doped tunnel junction is n-doped with silicon (Si), and the doped tunnel junction is p-doped with  $\text{CBr}_4$ . It would have been obvious at the time of applicant's invention with VCSEL and DBR because it would have been obvious to one having ordinary skill in the art at the time the invention was made to substrate is n-doped with the element selenium (Se), the reflective device is n-doped using tellurium, the doped tunnel junction is n-doped with silicon (Si), and the doped tunnel junction is p-doped with  $\text{CBr}_4$ . It would have been obvious at the time of applicant's invention, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

Claims 19 – 23, and 33 – 37, are rejected under 35 U.S.C. 103(a) as being unpatentable over Sugiyama et al (5,392,307) in view of "Accurate control of Sb composition in  $\text{AlGaAsSb}$  alloys on InP substrate by molecular beam epitaxy" by G. Almuneau, E. Hall, S. Mathis and L.A. Coldren (July 26, 1999) and WO 98/07218, Jayaraman (February 19, 1998).

**Regarding claims 19 – 23, and 33 – 37** Sugiyama discloses the claimed invention except for the distributed Bragg reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where “a” and “b” indicate relative proportions of atoms and “a” is greater than 0.9 or less than 0.3 in one layer of the alternating layer pairs and less than 0.9 or greater than 0.3 in another layer of the alternating layer pairs and “a” is less than 0.3 in one layer of the alternating layer pairs “a” is large enough such that the layer is substantially transparent to lasing light. It would have been obvious at the time of applicant’s invention, to combine “Accurate control of Sb composition in AlGaAsSb alloys on InP substrate by molecular beam epitaxy” by G. Almuneau, E. Hall, S. Mathis and L.A. Coldren (July 26, 1999) of teaching a distributed Bragg reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where “a” and “b” indicate relative proportions of atoms and “a” is greater than 0.9 or less than 0.3 in one layer of the alternating layer pairs and less than 0.9 or greater than 0.3 in another layer of the alternating layer pairs and “a” is less than 0.3 in one layer of the alternating layer pairs “a” is large enough such that the layer is substantially transparent to lasing light with DBR and VCSEL because it would have been obvious to one of ordinary skill in the art at the time the invention was made to distributed Bragg reflector comprising a plurality of layers are comprised of alternating layer pairs of  $\text{Al}_a\text{Ga}_{1-a}\text{As}_b\text{Sb}_{1-b}$  which are approximately lattice matched to InP, and where “a” and “b” indicate relative proportions of atoms and “a” is greater than 0.9 or less


0.3 in one layer of the alternating layer pairs and less than 0.9 or 0.3 in another layer of the alternating layer pairs and "a" is less than 0.3 in one layer of the alternating layer pairs "a" is large enough such that the layer is substantially transparent to lasing light, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Delma R. Flores Ruiz whose telephone number is (703) 308-6238. The examiner can normally be reached on M - F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Ip can be reached on (703) 308-3098. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 306-3431.



Delma R. Flores Ruiz  
Examiner  
Art Unit 2828



Paul Ip  
Supervisor Patent Examiner  
Art Unit 2828

DRFR/PI  
November 13, 2002